

XROTOR

X-shaped Radical Offshore Wind Turbine for Overall Cost of Energy Reduction

D7.1

Methods to identify and convene stakeholder communities

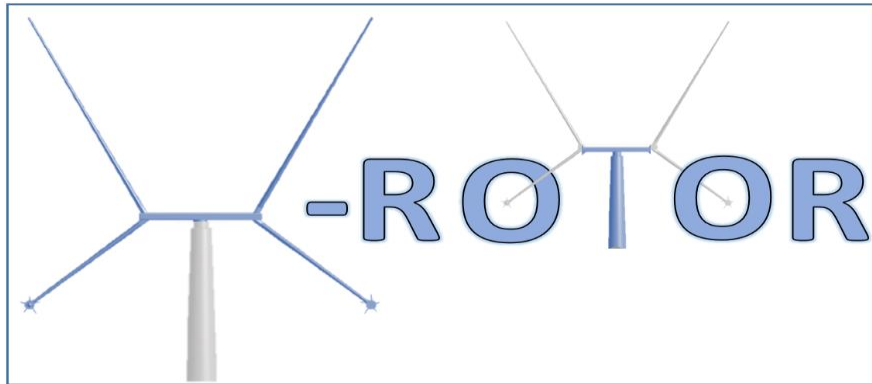
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September 2021



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101007135



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X-ROTOR Consortium



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About X-ROTOR

X-ROTOR: “X-shaped Radical Offshore wind Turbine for Overall cost of energy Reduction” is a Horizon 2020 funded project which aims to develop a disruptive new offshore wind turbine concept.

The X-ROTOR project is led by University of Strathclyde (UK) in partnership with Norwegian University of Science and Technology (Norway), Delft University of Technology (Netherlands), University College Cork (Ireland), Fundacion Cener National Renewable Energy Centre (Spain) and GE Renovables España (Spain).

As the effects of climate change are becoming ever more visible, Europe has raised its target for the amount of energy it consumes from renewable sources from the previous goal of 27% to 32% by 2030. Offshore wind energy can play a key role in achieving the EU target and contribute to the required 40% reduction in CO₂ emissions. However, to achieve the previously mentioned targets the cost of offshore wind must be reduced. The X-ROTOR concept provides a direct route to drastically reducing both capital and operating costs of energy from offshore wind.

The project runs for three years from January 2021, during which time, the concept will be developed through a holistic consideration of technical, cost, environmental and socio-economic impact aspects.

If proven feasible, X-ROTOR will, as a disruptive new offshore wind turbine concept, create new opportunities for the European wind energy industry and play an important role maintaining the EU’s position as global technological leader in renewable energy, reducing greenhouse gas emissions and decarbonising the EU economy.

For more information see <https://XROTOR-project.eu>

Description of the deliverable and its purpose

This deliverable describes the methods to identify and convene the two groups of stakeholder communities who will assist the objectives of the project by providing input on how to assess and maximize the social, economic and environmental benefits of X-ROTOR.

List of acronyms and abbreviations

ASD	Asynchronous Structured Dialogue
DoA	Description of Action
GHG	Greenhouse Gases
LCOE	Levelized Cost of Electricity
O&M	Operations and Maintenance
OEM	Original Equipment Manufacturer
RRI	Responsible Research and Innovation
SWOT	Strengths, Weaknesses, Opportunities and Threats
WP	Work Package

1 Introduction

1.1 Background

The X-ROTOR project aims to develop a disruptive new offshore wind turbine concept. An important evaluation of new technologies is the identification of applications and situations where there are clear advantages for the stakeholders over the status quo – in this case X-ROTOR turbine concept compared with the usual three blade horizontal axis turbine.

This document is an output of work package 7, the objective of which is to assess and maximize the social, economic and environmental benefits from the novel X-ROTOR turbine concept. In essence, this involves identifying situations in which X-ROTOR is a better, more profitable, more acceptable and a better fit than the conventional turbine design(s). For instance, aspects of this novel turbine to be considered include a lower levelized cost of electricity (LCOE) and a lower tip height than a similarly powered conventional turbines. In addition, since the secondary rotor blades have a much higher tip speed than is the case with other turbine designs, there may be potential noise issues¹.

A key part of the evaluation of the X-ROTOR concept will be realised through engagement with key stakeholder groups. It is planned to convene two such groups, namely: prospective host communities whose work and lives would be directly affected by the X-ROTOR after commercialisation of the technology, and the wider wind energy community who have a professional interest in the development of novel turbine designs such as the X-ROTOR concept. This document is intended as a preliminary and preparatory report which defines and outlines the approach to be taken in the identifying and convening of the stakeholder groups that are the focus of the social analysis within task 7.1.

This stakeholder groups which will be discussed in more detail in Section 1.2 below, are:

1. Prospective host communities, which will be engaged to better understand their practices, attitudes and values of relevance to the novel wind turbine design, and to examine how – from their perspective – the X-ROTOR design compares with conventional turbine designs.
2. Wider wind energy community, which will be engaged ascertain their opinions and preferences on design (and related) issues including: turbine rating, siting, support structure (fixed/floating), shore-side facilities, installation requirements and operations and maintenance (O&M) practices.

1.2 Overview of stakeholder groups

Group 1 has been described in the Description of Action (DoA) to include those who could prospectively play host to an X-ROTOR turbine, namely: coastal communities, fishers, environmental groups, the shipping

¹ These noise issues will be examined in detail in the context of D7.12 on noise modelling and D7.13 which comprises an environmental noise assessment.

industry, the oil and gas industries, tourism groups, policy makers and regulators, *etc.* The participants will comprise at least 50 members at least 30% of whom are female, from at least 5 different host communities in at least three different European countries. The membership of the host communities is considered individually in Section 3.2.

Group 2 has been described in the DoA as consisting of developers, researchers, consultants, standards bodies, operators, vessel companies, installation companies, O&M providers and Original Equipment Manufacturers (OEMs). These are considered individually in Section 4.1 and will comprise at a target of 50 members, at least 30% of whom are female, from 5 or more relevant sectors.

Perhaps the most fundamental difference between these two types of stakeholder communities is that the members of the wind energy community chose to join that community to work in wind energy and with the hope to benefit from it, while most of the members of a host community did not decide to join their community because of wind energy and may or may not benefit from it.

A practical difference between these community types is size of their area of principal interest. The wider wind energy community is multinational by nature, but host communities have a much more focused area of interest. Thus, a host community may be meaningfully defined within a few tens of km, but the wind energy community may be meaningfully defined across several countries or even across an entire continent. In the context of a European based research project it may therefore be reasonable to refer to *the* wider wind energy community across the European continent as the community in question (Section 4) and refer to a host community by firstly defining a geographical region (Section 3.1) and then identifying participants of each host community (Section 3.3).

1.3 Structure

This report is structured in the following way:

- This first section presents an introduction to the report, details the background to the work, provides an overview of the stakeholder groups, and presents the structure of the document.
- Section 2 comprises a treatment of the theoretical basis for the approach adopted for identification and convocation.
- The third and fourth sections contain the methodology used for identifying and convening Group 1 (prospective host communities) and Group 2 (wider wind energy community) respectively.
- Section five draws some conclusions from the preparatory work undertaken and details how this will be used in future work of the project.

2 Theories and Concepts

The following section discusses the ideas and theoretical underpinnings of the selection and convocation methods. Firstly, the application of the Horizon 2020 policy of Responsible Research and Innovation is discussed in Section 2.1, followed by some considerations of the methods and terms of engagement for this project in Section 2.2. A short summary of the aims for the engagement is given in Section 2.3.

2.1 Responsible Research and Innovation

Following a Responsible Research and Innovation (RRI) approach will ensure that the X-ROTOR research project has legitimacy and credibility (European Commission, 2020). For this project RRI means that the researchers and the stakeholder groups work together so that the conduct and outcomes of the research are in concord with the values expected by society. RRI includes adhering to ethical research standards, such as ensuring gender equality. It also includes using open access for as much of the output as possible so that a wide range of people may learn from the research, most of which after all is publicly funded.

The aim is to follow a participatory research approach which requires that stakeholders be part of the research process, so that their practices, values and attitudes should feed into the project (Tumiel-Berhalter, Watkins and Crespo, 2005). It is therefore necessary that the selection of which communities are involved and the selection of the members of each community should be transparent and clearly understood. This will encourage trust and hence participation, in the research process.

Those who fund public research now insist that host populations from whom research subjects are drawn, are consulted with and have a voice in the negotiations which direct the research process. This is the case all over the world from Australia (Sullivan, 2020) to the specific case here of an EU funded projects (European Commission, 2020). Sullivan (2020) found that doing research without the consent of the host community, in her case Aboriginal people, has produced mistrust, animosity and resistance (Martin and Mirraboopa, 2003). It is therefore necessary for the success of the engagement that as wide a range of participants as possible are involved in the conduct, terms and outcomes of the research project, that the selection of participants is clear and fair, and that the degree of influence given to the participants is made clear to them. These ideas are explored in the next section.

2.2 Public Engagement

The research project's interactions with the host communities and the wider wind energy community, are both public engagements. Both groups are members of the public and so the considerations of inclusivity, the level of engagement and the value to be placed on individual engagement are relevant to both groups. The first consideration is to decide how to select participants.

2.2.1 Selection of Participants

Selection should happen at two levels, firstly there should be a wide invitation made to the stakeholder communities so that all stakeholders are in that sense included in the process (Revez *et al.*, 2021). At a second level, there should be specific actions to ensure that participants who are usually underrepresented are invited to take part.

At the first level, and with the host community specifically in mind, local community involvement is necessary for the implementation of EU energy targets and renewable energy adoption (Dvarioniene *et al.*, 2015). One model for this is The Energy Lab (an application of the Living Lab concept) which brings current research and innovation into local geographically defined communities in the public – private – people partnership (4P). This is a general model for the adoption of a wide range of renewable energy and GHG reduction technologies in Europe. The community in the 4P vision is not only the recipient of the technology but its inspiration. The Energy Lab proposes: open innovation, involvement of the community in the innovation process and using the research output in the community who designed/desired them. While this requires a great deal of work at the start of a process of change, such as is considered with X-ROTOR, there are benefits later. These benefits include the avoidance of problems with the implementation of the ideas coming from the research process, precisely because of the multiple perspectives used in the testing and design, and because of the sense of community ownership of research output. In the application to the energy needs of a community, the Energy Lab requires the involvement of stakeholders. The rationale for involvement of everyone who takes an interest and the reason for giving them decision power, is that this method encourages acceptance of the new plan, gets “buy-in”, and manages possible objections and opposition. Dvarioniene *et al.* (2015) suggest that stakeholders should include political representatives, banks, lawyers, planners, affected citizens, community leaders, and local investors and businesses. This is very much in line with the existing plans the stakeholder groups as described above in Section 1.2.

At the second level, engagement means taking action to prevent opinions from richer, noisier or more highly educated stakeholders dominating the opinions of others, by deliberately including underrepresented stakeholder groups (Petkovic *et al.*, 2020). The causes of such underrepresentation listed by Petkovic *et al.* (2020) are:

- Place of residence;
- Race/Ethnicity;
- Culture/Language;
- Occupation;
- Gender/Sex;
- Knowledge of subject;
- Religion;
- Education;
- Socioeconomic status;
- Social capital;
- Age.

It is therefore important to ensure that the groups of people who might be excluded by these causes are actively and passively included in the participant selection process. Actively, by deliberately seeking out those who are excluded and passively, by ensuring that the methods chosen for engagement do not mitigate against participation, by for example problems with access to buildings or times of meetings. This is dealt with in greater detail for each stakeholder community in Sections 3.3 and 4.2.

2.2.2 Levels of Engagement

It is important to be honest regarding the level of influence which this research project offers the stakeholder communities. Public engagement may be considered as various levels between a minimal and a maximal participation and involvement. Sorensen *et al.* (2002) use three levels of public involvement where the public are receivers of information, are consulted in the planning decisions or are financially involved as co-owners. As the project has received its own funding there is no level similar to Sorensen’s ownership level. Figure 1 presents a four level plan, based on Petkovic *et al.* (2020) which expands the second level of Sorensen *et al.* (2002). The lowest of the four levels in Figure 1 involves the researchers merely informing the community of what is being proposed; this may be similar to posting public notices for planning permission to fulfil an externally imposed obligation. The next level is “listening”, where opinions are actively sought out, in a similar way to the researchers seeking data which is useful. “Involving”, means that the opinions from the public may become part of the researchers’ plan or may not. “Collaborating”, takes the public seriously and acts on the input from those whose opinions were gathered, this is the aim for the project.

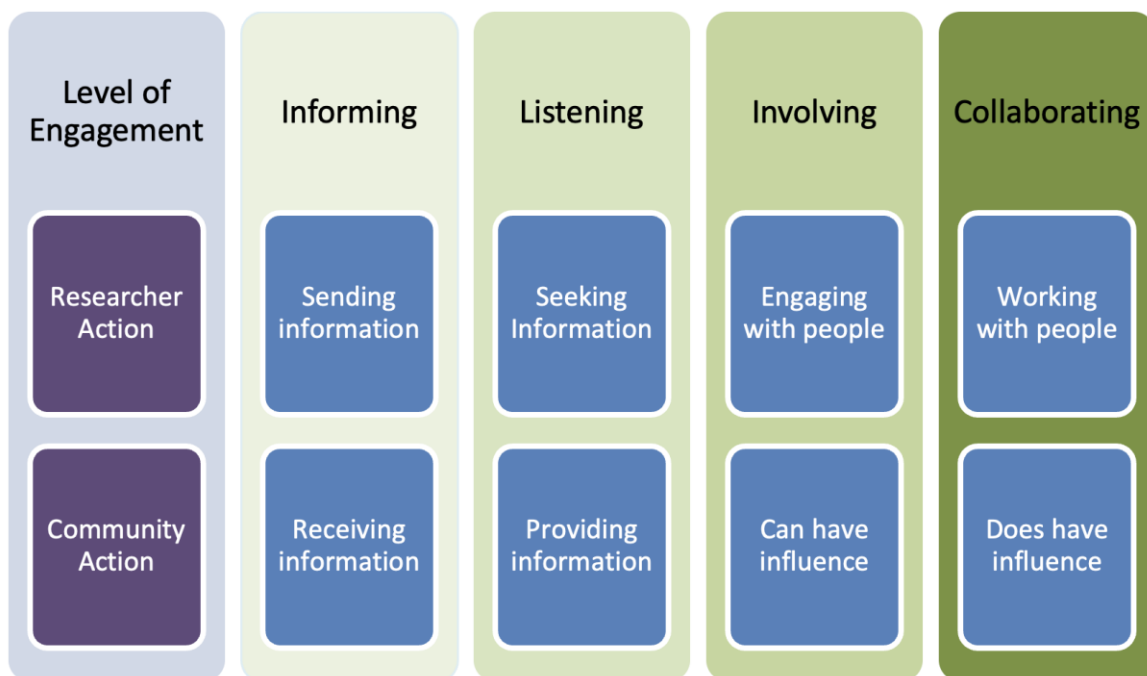


Figure 1 Levels of Engagement

2.2.3 Valuing all Opinions Equally?

An interesting question is raised by Haggett, (2011) who asks whether extra weight should be given to the opinions of people who are more strongly affected by a new technology, such as X-ROTOR. For example, is it right that the concerns and opinions of those who fish directly beside offshore wind farm sites, should have more weight than the concerns and opinions of people living out of sight of the turbines?

Deciding who to include in the engagement is a difficult question, as is the issue of whether greater weight should be given to people who are more seriously affected by the development (Sorensen et al., 2002). For example, there are large populations living far from the coast who will benefit from having access to renewable energy but the presence of X-ROTOR will have barely any effects on these people. Is it reasonable to include such a population in the survey?

2.3 Summary of Aims

- To hear positive and negative reactions to the X-ROTOR concept;
- To obtain a diversity of views particularly women, young people, old people, economically disadvantaged people, minority groups and others who are often excluded;
- To propose a method to select communities and methods to listen to them which respect the ideals of science and society;
- Carry out a SWOT analysis with the wind energy community;
- Look for ways to maximize the social acceptability of X-ROTOR with the various host communities – in what circumstances does X-ROTOR offer an advantage compared with standard turbines?

3 Group 1 Host Communities – Methodology to Identify and Convene

Group 1 (Host Communities) is intended to comprise at least 50 people from 5 different host communities from at least three different European countries. There will be at least 30% female participation. It is proposed that on site meetings with host communities should occur in years 2 and 3 of the project as it is not possible to do so in year 1 due to Covid-19. As a host community is defined geographically, there follows a discussion of the criteria for selection of which host communities to select in Section 3.1 **Error! Reference source not found.** Discussion of how to select individual participants from the host communities follows in Section 3.3. A discussion of the general criteria and individual characteristics of host communities follows.

3.1 *Selecting Host Communities*

Perhaps the most important single criterion for selecting a host community, whose opinions will direct part of this research project, is that the host community should have a good degree of knowledge about wind energy and renewable energy generally. There is little point gathering opinions which are not based on knowledge. A way to do this is to select one principal host community which will be the focus of the engagement and to select additional satellite host communities who will present opinions and ideas from other geographical areas. The principal host community should be one which would be very likely to eventually play host to the X-ROTOR technology. The satellite communities would be secondary choices for deployment of the technology. This arrangement makes it possible to focus the effort and resources of the research on a host community which is most relevant, while also listening to other communities. Since the engineering part of this project is led by the University of Strathclyde, an obvious location for the principal host community is in Scotland as the site testing of the X-ROTOR will most likely take place there.

The principal host community may therefore be found near the Scottish coast. To ensure that the community is clearly affected by the presence of a new offshore wind technology such as X-ROTOR it would be reasonable to pick a small town or island which has a good variety of people living close to a proposed X-ROTOR site. A large town or city would be less suited as fewer of the population would be directly affected by offshore wind turbines.

On a practical level, the communities chosen should be willing to participate and it should be possible to find researchers who have suitable language skills to understand the community members properly. These criteria are illustrated in Figure 2.

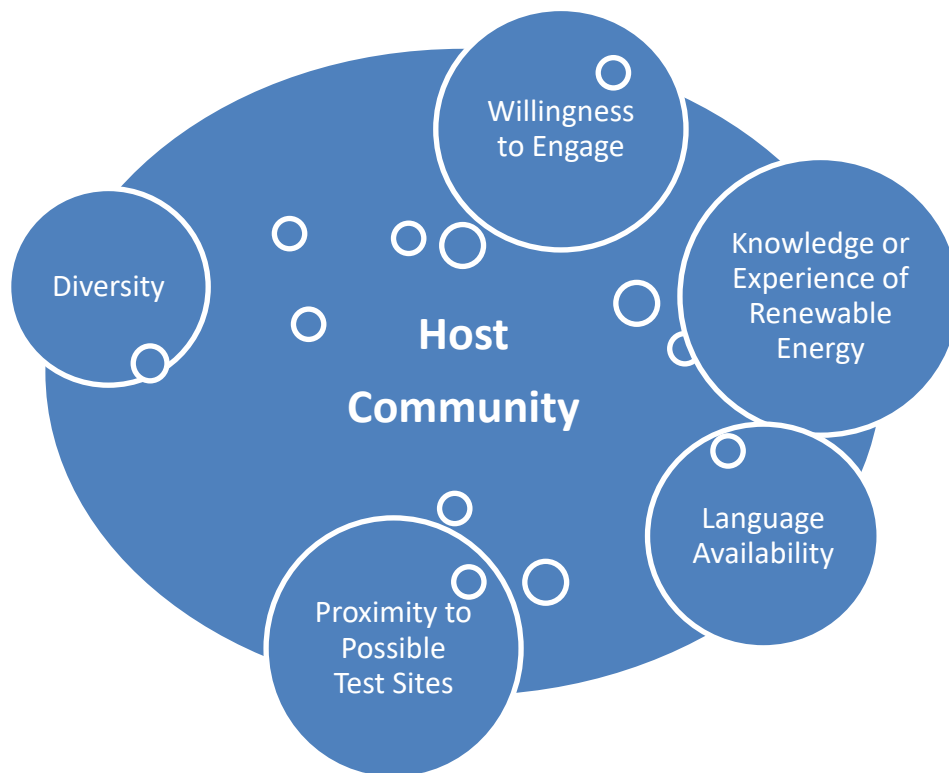


Figure 2 Characteristics of a Host Community

Fishers are a very important group as they are directly affected by the presence of the X-ROTORS and also people in coastal communities are likely support each other and amplify the needs of the fishers (Haggett, 2011). It would therefore be useful when selecting host communities to ensure that at least half of them contain fishers. Even then there is a question of which fishers to include. For example, it is possible to select (a) the fishers who use the nearest port, or (b) the fishers who actually fish in the waters where the turbines will be placed. The first set of fishers are easily defined and since there will be an impact on port use, they are clearly all affected. It is considerably more difficult to clearly define where fishers fish. Many are not keen to share such information for understandable commercial reasons, many of the smaller fishing boats do not carry automatic identification system transponders which track their location, (for similar reasons as well as cost). In any case it should be an important consideration that fishers are consistently represented in the host communities (Kamidelivand and Cummins, 2020).

- Principal Host Community in Scotland;
- Satellite Host Communities outside Scotland, at least two of which are in Europe;
- Experience of Wind Energy, possibly offshore wind;
- Knowledge of renewable energy and power production;
- Presence of fishing industry.

3.2 Identification of Communities within the Host Communities

The participants' attitudes to X-ROTOR are likely to be formed and framed within their attitudes to offshore wind farms generally. There are many factors associated with opinion formation regarding offshore wind projects. The following have been found to be significant: the visual impact and the value of the sea scape, the local attachment to the area, whether outsiders are trusted, and opportunities which are presented for discussion and involvement in the project (Haggett, 2011). The age, gender, income, education and length of residence of the audience plays a part too, (Firestone and Kempton, 2007; Ladenburg, 2010). However, Alexander *et al.* (2013) found that among those in the fishing community, gear type, association membership and experience did not influence attitudes to offshore renewables, they did find that knowledge of an actual development was associated with negative feelings, as did working from the mainland rather than on an island. (This is not to say that knowledge causes negative feelings, as it is also possible that those with negative feelings may be inclined to increase their knowledge.)

There are clearly a large number of factors influencing the underlying attitude to offshore wind projects, which can be assumed to colour the attitude to X-ROTOR. Factors affecting the specific acceptability of X-ROTOR are expected to include the choice of turbine rating, where the turbines are sited, whether they are floating or fixed to the seabed and the presence and size of the shore facilities. With these factors in mind the communities within the host communities are now considered.

3.2.1 Coastal Communities

To define what is a coastal community is not a simple task. Criteria may include distance from a possible X-ROTOR site or being within line of sight of such a site. Proximity to the coastline is not as useful as it may seem, as most cities are beside the coast but many people living in cities may not consider the marine environment to be a personal concern or part of their identity. Despite the difficulties it is possible to proceed with a broad understanding of coastal communities being within, say 10 km of the coast and having at least one port or harbour nearby.

3.2.2 Fisheries

Since the fishing industry already uses the sea, it is clearly highly impacted by offshore wind turbines and is therefore of great importance to the X-ROTOR project. The choice of which fishers are most affected by the X-ROTOR technology depends on the type of fishing and the gear used. Most fishers in the west coast of Scotland mostly use quite small boats, less than 10 m, and fish for shellfish, scallops, crabs, lobsters and shrimp (Ireland is similar). They are generally positive or neutral regarding renewable energy. Lobster and crab fishers will definitely be affected by a change in offshore wind turbine technology as they operate close to the shore where fixed turbines are located and where cables to carry the electricity to shore are located. Pelagic fishing operating far offshore where there is more space may not be directly affected as strongly. Fishers will be well aware of the difficulties involved with sharing the same sea as offshore wind, as they are already aware of the difficulties of sharing the sea with each other and the other users of the sea.

Kamidelivand and Cummins, (2020) specifically address the concerns of fishers and offshore wind farm developers in Ireland. Their study found that all the participants believed that offshore wind and the fishing industry could co-exist. In order to achieve the objective of a mutually beneficial co-existence it is necessary to have early and continuous communication between the wind farm developers and the fishing community. Early consultation of fishers will allow the wind developer to benefit from their local knowledge, particularly in relation to site selection which can be of benefit to both parties. Developers normally contribute to a community benefit fund which can support local fishing and the community generally². There are also opportunities for fishers to hire vessels for transporting workers to offshore turbines, though this depends on local licencing³. Another issue for fishers is that there is normally no fishing near to offshore wind turbines (Kamidelivand and Cummins, 2020), The problem from the developers' point of view is that they usually do not want fishers operating close to power cables (or mooring lines for floating turbines) in case there is damage to the cables etc. The fishers, on the other hand, do not want their own gear to be snagged, nor do they want to be blamed for any damage done to the cables or moorings. This would be an important issue for fishers.

3.2.3 *Environmental Groups*

A host community may have its own environmental groups or there may be regional or national environmental groups available for consultation. The input from these groups would be expected to reflect the complex nature of offshore wind turbine siting as there will be advantages and disadvantages from an environmental point of view. For example, birds may be killed by the rotating turbine blades, wildlife may behave differently because of the noise of the blades and there is disturbance to the seabed from installation of any type of offshore wind turbine (less so for floating). On the positive side, shellfish and other sea life may benefit from a new habitat formed by the foundations of the turbine and typically there will be a net-fishing free zone around the turbines and their moorings, offering a de facto marine reserve. Added to this is the reduction in GHG emissions as a direct result of offshore wind installation. A local environmental group may be useful by offering their opinions comparing these advantages and disadvantages for X-ROTOR compared to regular turbines.

3.2.4 *Shipping Industry*

Shipping lanes are already defined and so, new offshore developers will not get permission to place turbines in these lanes. Discussions with the shipping industry may involve issues about plans for future shipping lanes, interference with radar and the need to be able to locate turbines at night and in fog. In addition to members

² In Ireland there is a mandatory €2/MWh contribution to community benefit from onshore wind (DCCA, 2020), In Scotland onshore wind community benefits are voluntary and excluded from consideration for planning permission Scottish government (see <https://bit.ly/3CCq81k>), however the rate of Stg£5,000 per installed MW per year is encouraged.

³ In Ireland boats may be registered for fishing or for passengers, but not for both.

of the coastal community, there are representative organisations for the shipping industry, which should be able to provide assistance to the research.

3.2.5 *Oil and Gas Industry*

If testing for oil or gas is likely to be carried out near X-ROTOR this will clearly present a problem, but it is increasingly unlikely that oil or gas testing will be supported by governments in Europe. Again, if an oil or gas rig is already in place a wind farm will not be permitted nearby to avoid danger to the existing structures.

3.2.6 *Tourism Groups*

There is likely to be hesitancy on behalf of local tourism groups to the arrival of an offshore wind turbine. Some of this concern may be answered with the slightly lower maximum tip height of X-ROTOR compared to similarly powered standard turbines. It may also be the case that there is a novelty value to the new turbine design. Tourism is an important employer and source of income for many coastal communities. The tourism industry can be represented, both locally in the community and from national level organisations.

3.2.7 *Policy Makers*

National level policy makers in particular can be expected to see the benefits of offshore wind for the energy mix and for the achievement of GHG targets. Much may depend on how close policy makers are to the coastal community and to what extent their support relies on people affected by offshore wind installations.

3.2.8 *Regulators*

In Scotland there is a single regulatory authority for the marine sector. This will also be the case in Ireland shortly. Denmark has a Danish Maritime Authority. The presence of a single regulator makes it more straightforward to identify who should be invited to be part of the host community.

3.3 *Recruiting Participants from Host Communities*

The purpose of the engagement with the host communities is to understand the attitudes and concerns of the host community and maximize the opportunities and synergies presented by X-ROTOR. With these purposes in mind, the choices of how to select participants is addressed.

The essential approach is given by Alvial-Palavicino et al. (2011) who propose a three step process for community engagement, first is to build trust, then co-construction and thirdly ensuring sustainability. In this case co-construction refers to using the communities' input for the design and site selection for the X-ROTOR, while the third step of ensuring sustainability in this case refers to the continued use and adoption of X-ROTOR.

Evans (2009) and Revez *et al.* (2021) acknowledge that the ideal is for a random sample of participants to be taken from the target population, in this case the host communities. In practice however most researchers use convenience sampling, where researchers will ask for volunteers from people who are present in the community, such as at shopping centres, online or at community events. The selection of participants may

be adjusted by stratification so that the sample used for inferences from the research, may be a more accurate representation of the whole population. In the present case, our aim is for a comprehensive selection of opinions and ideas and so stratification will not be necessary.

An initial contact may be made in several ways such as by phone, mail or email. These three methods have advantages and disadvantages. Firestone and Kempton, (2007) surveyed residents selected randomly from the phone book. This presents problems with the representativeness of the method. Namely are phone owners who decide to allow their name to appear in the phone book more likely to be for or against renewable energy? Is there a correlation between ownership of a land line and age? And between age and support for renewables? However, this is a convenient method, and demonstrates to the participant that the researcher went to the trouble of talking to them. This demonstration may improve the likelihood of cooperation. Ladenburg, (2010) used a random selection of 1,000 people out of a population of 17,000 in an internet panel of Danish adults. This is useful for a large sample of a country but may be less useful for sampling a “coastal community”, as it relies on the availability of an internet panel. Alexander et al. (2013) used a more direct method targeting a specific population, fishers. This would be useful if it is found that there are few fishers among the participants.

Table 1 Selection Methods for Group Participants

Sample Selection Method used in the literature	Interaction	Paper
Randomly selected local residents from phone book	Phone	(Firestone and Kempton, 2007)
Taken from the UK Fishing Vessel List managed by Marine Scotland Compliance. 481 questionnaires sent, 107 returned (total of 915 registered vessels)	Postal	(Alexander et al., 2013)
Randomly selected from a panel of people on an internet panel	Email	(Ladenburg, 2010)

3.3.1 Gatekeepers

Gatekeepers should, in so far as it is possible, be representatives of the local community, trusted by the community and fair. While it is difficult to assess these qualities, some acknowledgement of these requirements should be considered. Gatekeepers can be non-representative of the community which can lead to difficulties regarding the level of cooperation from the rest of the community. It is therefore wiser to have more than one gatekeeper per community.

3.3.2 Making Initial Approaches to Individuals in the Host Communities

There will be an initial invitation to people in the host community who have been suggested by locally based gatekeepers, or who volunteer their interest as a result of a locally based publicity campaign. This will be augmented by asking for volunteers to attend a focus group meeting when researchers visit the community itself.

3.3.3 Possible Omissions

Even with the proposed number of people being consulted in this research project, it cannot be assumed that the opinions gathered by the researchers represent the views of the whole community. While this is not the aim of the engagement, it is likely that there are stakeholders who have not been represented in the engagement. Perhaps some are too busy to engage with the process (Tumiel-Berhalter, Watkins and Crespo, 2005) or who lack agency. It is more concerning that there could be systematic absences, which would leave some voices absent from the engagement.

Some typically under-represented groups are: Young people; recently arrived members of the community from outside the area, or from outside the country; people who are housebound who lack the ability to attend public meetings or who wish not to mingle with crowds, which may be a particular concern after the Covid-19 pandemic (Revez *et al.*, 2021). It is important to make particular efforts to contact people in these situations so that they may be encouraged to take part in the research.

3.4 Convening the Host Communities

After selecting the participants, the next step is to call the host communities together. This may occur using a blend of online and in-person meetings as well as using asynchronous contacts between participants by email, message boards or social media.

In order to make the best use of the research resources and to ensure a successful engagement with the host communities, it is necessary that after the initial selection of the participants, there are repeated flows of information between the researchers and the participants. This can be approached in much the same way as a marketing campaign for a new product launch. The objective of the information campaign will be to get the host community generally, and the participants in particular, to talk among themselves regarding the X-ROTOR project and the up-coming meetings, social media events and messaging opportunities. This will greatly assist online and face to face meetings by encouraging a high level of attendance and awareness. A structured set of activities such as were used in Revez *et al.* (2021) was found to be very successful for a similar situation of meeting with a local community. However, in our case the objective is much more clearly focused on maximizing the benefits of the X-ROTOR for the community, rather than the aim of envisioning the future of a small community. Ways of raising awareness of the X-ROTOR project include:

- Advertising in the locality, by social media, local radio, local newspapers;
- Approaching individuals as identified by gate keepers to engage with their friends and colleagues;
- Approaching individuals as identified by other individuals;
- Connecting with existing organisations who have experience of similar research;

- Connecting with existing organisations who represent groups of people who would traditionally be under-represented, *e.g.*, Parent and Toddler groups, Youth Clubs, Elderly Support groups, Traditional Music groups, Schools, Immigrant Support groups *etc.*;
- Contacting existing groups of people who are directly identified in the DoA such as local environmental groups, fishing organisations, tourism groups, politicians, regulators and those with specific interests in renewable energy.

These methods of raising awareness are particularly important in the run up to a face-to-face meeting, where the researchers are asking participants to freely give of their own time. Advice from people with knowledge of marketing strategies would be useful in this regard.

It would be expected that communication with the host communities will be predominantly remote with c. 2 physical workshops or other arrangements (see Table 4). The satellite community meetings could be carried out entirely online if necessary.

3.4.1 *Physical Meetings*

From a human point of view, there is little to compare with a physical meeting as a way for a community to experience itself and express itself. At a physical meeting there is a huge opportunity to exchange information and build relationships which will encourage dialogue and understanding. From a practical (and environmental) point of view, there will be a limited amount of time for the researchers to meet host communities, and so, all that can be done to make the meeting with community successful should be done. Successful meetings begin, as mentioned above, before the meeting with the pre-meeting publicity. The event itself needs to respect those who attend so issues about location and timing are crucial to the success of the meeting because the location and timing of meetings can determine who is able to take part.

Location is important in that it may exclude those without access to transport, there should be attention paid to any political, religious or social meaning conveyed by the location and whether this would favour or exclude people. While a bar or hotel can be convenient and appear welcoming it may not be so for everyone. There can be divisions between who will be welcome in different pubs based on the history of the community. Schools can act as useful venues provided again that there is no sense of exclusion for part of the community. The time at which a meeting takes place is as important as the venue. Clearly not everyone is available all of the time. Availability will depend on age group, employment status, health category and willingness to change a personal schedule. A simple solution is to offer multiple physical meetings which may require tight timekeeping, which may in itself encourage attendance. Some advantages and disadvantages are given in

Table 2.

Table 2 Pros and Cons of Physical Meetings

Positive	Negative
Real connections can be made	Previous negative feelings can be brought into play
Human to human level interactions	Inaccessible buildings
Opportunity to meet new people	Time consuming
Community can experience itself	Expensive
	Unwelcoming buildings

3.4.2 Online Meetings

Online meetings have many advantages and disadvantages compared with physical meetings (Revez *et al.*, 2021). On the positive side they are relatively easy to arrange, particularly after the experience of Covid-19. They allow groups which are physically far apart to meet, there is easy accessibility to video and slide presentations and require only that attendees have a smart phone. On the negative side, since they are easy to set up participants do not have to invest effort in attending and so may not value the time of others. It has been seen during the past year and a half that attention during online meetings can be lacking. The online world is open to a great deal of misinformation and this can leak into online meetings. Online meetings require a good broadband connection, something which may be lacking in remote coastal areas. People may behave differently in front of a small screen than in front of a real group of people, this can stifle civilized debate. A summary is presented in Table 3

Table 3 Pros and Cons of Online Meetings

Positive	Negative
Quick	
Cheap	Do not require a high personal investment
Access to lots of information	Open to misinformation and manipulation
Good for dispersed groups	Require good broadband connection
Good for marginalised groups	Cyber-bullying can easily be present
	Can repeat negative messages and avoid criticism

3.4.3 Using Existing Host Community Events

Host communities will usually have annual events such as sports competitions, shows and festivals. These offer opportunities to the researcher to hold a recruitment event alongside the main community event, or to hold a physical or online meeting alongside the main community event. Community events can bring together a very wide selection of people in the community in one convenient location for a period of time. On the other hand, they can attract many tourists and visitors who are not really part of the community and whose opinions might skew the results. However, there is a possibility of using such events.

3.4.4 Proposed Group Selection and Workshop Schedule

A proposed schedule for selecting and meeting the stakeholder groups is presented in Table 4.

Table 4 Group Selection and Workshops

Group	Year 1	Year 2	Year 3
Principal Host Community	Select the Principal Host Community	Select participants from the Principal Host Community Workshop 1 with Principal Host Community	Workshop 2 with Principal Host Community
4 Satellite Host Communities	Select Satellite Host Communities 1 and 2	Select participants from Satellite Communities 1 and 2 Workshops with Satellites 1 and 2 Select satellite host communities 3 and 4	Select participants from Satellite Communities 3 and 4 Workshops with Satellites 3 and 4
Wind Energy Community	Select participants from the Energy Community	Workshop 1 with Energy Community	Workshop 2 with Energy Community

Note: A way to ensure that we have three different European countries and five different communities, as described in DoA, is to make sure that the Satellite host communities 1 and 3 are not from the same country as the principal host community.

3.5 Engagement Methods

Multiple methods will be used to engage with the participants. The aim of the engagement is to explore the community attitudes regarding the acceptability of X-ROTOR compared with standard turbines. To achieve this, multiple opinions need to be expressed and gathered, hence the need to use multiple methods of engagement.

Alexander et al. (2013) considers four methods of surveying the opinions of a group of people, see Table 5. There are various advantages and disadvantages of face to face, phone, mail and online surveys. In order to conduct the most effective engagement face to face would be the ideal method, though this does involve more effort and cost than the others as discussed above in Section 3.4.1. It does have the advantage that surveying face to face can be combined with meeting the group as a whole and conducting a reflective dialogue with the group.

Table 5 Engagement Methods (based on Alexander et al., 2013)

Method	Advantages	Disadvantages
Face-to-Face	High response rates, response bias low	Expensive and labour intensive; respondents unwilling to discuss personal behaviour and may feel pressure to provide socially desirable responses
Phone	High response rates, wide geographical range, rapport	Caller ID and messaging make it difficult to contact respondents. Labour intensive and costly.
Mail	Reduced cost, high population coverage, success in getting personal information	Response bias, so that those who are not interested or who do not like written communication may not take part.
Online	Low cost, high speed	In addition to the disadvantages of mail, respondents need to have internet access. This method can have very low response rates.

3.5.1 On Line Questionnaire

Online questionnaires have the advantage of not only gathering information but they also create awareness of the research project and can be used to publicise later meetings both physical and online. Possibly an adapted version of a Delphi study as discussed below in Section 3.5.3 could be useful for an online questionnaire. This can raise opinions, increase engagement at later face to face meetings and assure participants that their opinions are being listened to. Also, it lets participants know there are others also contributing and shows that opinions are treated fairly.

3.5.2 Workshops – Online and Physical

A workshop with a specific aim of producing perhaps a policy or survey results, could be used to assist the research. This will work better if the group are already familiar with the issues and each other. Such events have been described in Revez *et al.* (2021) and can be adapted for use here.

3.5.3 ASD - Delphi Study

An Asynchronous Structured Dialogue based on the modified Delphi Study method of Revez *et al.* (2020) can be used as this provides a flexible approach. This method is constructed so as to build consensus among those taking part and while normally a Delphi study is used to gather together the opinions of experts about the future, it has been adapted for general use. The essential aspects of anonymity and feedback are preserved. It would be possible to use this method either in a physical meeting, where some process would need to be designed to ensure anonymity, or to use it at a distance, possibly between the physical meetings. It is ideal as a way to let responses from the community develop over time. Delphi has been recommended in Petkovic *et al.* (2020) as a useful way to gather opinions.

3.5.4 Feedback

After the online survey, and as required by Delphi methodology, there will be feedback for all the participants. There should also be feedback after the research project finishes to show respect for those taking part and to pave the way for cooperation in the future.

4 Group 2 The Wind Energy Community – Methodology to Identify and Convene

Group 2 (the Wider Wind Energy Community) will comprise at least 50 people from at least 5 different relevant sectors, there will be at least 30% female participation. The wider wind energy community operates on a global scale, and so the definition of this community geographically is not useful as it had been above for the Host Communities **Error! Reference source not found.**

The purpose of meeting the energy community is to carry out a SWOT analysis of ways in which to increase the acceptability of X-ROTOR, and in particular to find out what are the critical factors which the energy community uses when deciding whether to select X-ROTOR. Clearly the lower LCOE of X-ROTOR will be desirable. The research hopes to discover what other factors come into the decisions made by the wind energy community, for example, the choices of turbine rating, siting, support structure (fixed/floating), shore-side facilities, installation/O&M etc. may all play a part in making X-ROTOR successful.

In order to find out what criteria go into making decisions for or against X-ROTOR it is important that participants from the triple helix of university, government and industry are acting in an unbiased way. For example, companies which have already invested a great deal in the standard three blade horizontal axis turbines may find the change of direction to X-ROTOR too far outside their current knowledge. It may be more useful for the research to select those who have not already committed to the standard technology such as new companies or smaller companies who may be willing to take on new ideas more easily than companies which have already committed themselves. In a similar way to that discussed above in Section 3.1, there are desirable characteristics for participants from the wind energy community notably:

- Independence – not already committed to three blade horizontal axis turbines;
- Willingness to cooperate;
- Language availability.

4.1 Characterising the Wind Energy Community

The roles and insights of each of the following sets of people within the wind energy community are considered as well as how they might they be affected by X-ROTOR rather than other technologies.

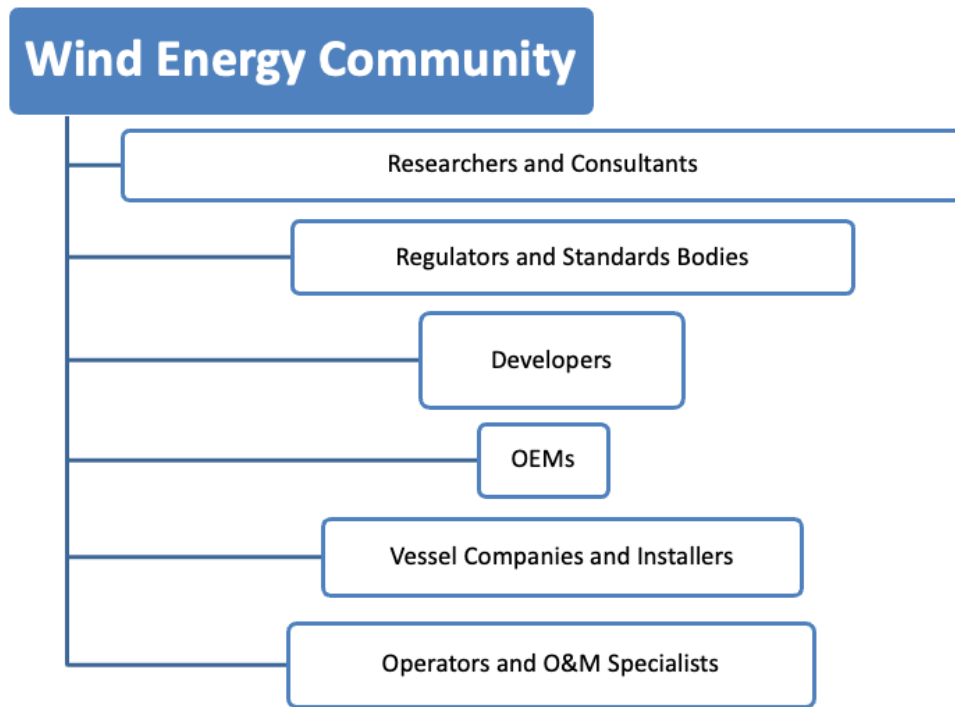


Figure 3 Wind Energy Community

4.1.1 *Researchers and Consultants*

The role of the researcher is to discover and report findings in an objective and fair manner. As is standard procedure for ethically sound research, researchers who may have even the appearance of a conflict of interest will either disclose any interest, or exclude themselves from the process of forming conclusions about the suitability of X-ROTOR.

The role of consultants is to solve problems for their clients. Consultants may have access to useful insights for the research. Similar to the researchers, consultants who might be in a position where there could be an appearance of a conflict of interest will either disclose any interest, or exclude themselves from the process of forming conclusions about X-ROTOR.

4.1.2 *Regulators and Standards Bodies*

From the point of view of regulators and those who set standards across the wind energy industry, the primary aim should be public safety and generation reliability. As X-ROTOR is an offshore technology, public safety should be mainly concerned with the technicians installing and operating the equipment.

4.1.3 *Developers*

Developers are the key movers in the process of bringing X-ROTOR to a mass market. Their opinions are key to the success of any new technology.

4.1.4 *OEMs*

Many of the existing parts being produced for three blade horizontal axis turbines will be directly usable for X-ROTOR, therefore OEMs may be open to a new market for smaller pieces of equipment. This is because

they have already invested in the design and manufacturing of what is now considered small scale turbines and will be interested in recouping this investment.

4.1.5 Vessel Companies and Installation Companies

Vessel companies and those involved in installation should be reasonably keen to see advantages for X-ROTOR, because, like OEMs, they have invested in equipment which in many cases now is too small for the newest largest turbines.

4.1.6 Operators and O&M Providers

The operators and O&M providers will need to learn how to adapt their existing expertise to a new design. This may present a challenge or an opportunity.

4.2 Selecting and Convening the Wind Energy Community

The same issues arise for the wind energy community as have been mentioned above in Section 2.2, namely that care must be taken to include as many voices as possible and to be aware of biases from the voices which are heard. This is particularly the case where a new and possibly disruptive technology such as X-ROTOR may compete for investment with the established technologies. In some ways the selection of participants from the wind energy community is easier as their motivation is more easily understood. The energy community wishes to encourage, develop and profit from the use of wind energy. This would be expected to be coupled with a desire to reduce GHG and work against climate change. The list of motivations of the host communities is much longer due to the greater diversity of people involved.

4.2.1 Selecting Participants

The ideal means of engagement is to meet members of the wind energy community face to face. To do this requires a great deal of planning and preparation to ensure that the objective of engaging with at least 50 members, at least 30% of whom are female, from at least 5 sectors is met. The first step in the engagement with the wind energy community, as it is with any community, will be to select participants and make contact with them. Contacts can be generated from existing lists, gatekeepers and by snowballing.

4.2.2 Contacts and Gatekeepers

The consortium already has a number of contacts in the wind energy industry, these can be a starting set of contacts which can be invited to participate in the research project. The consortium is also in a position to identify gatekeepers who could introduce more members of the wind energy community. The same provisos apply to the gatekeepers for the wind energy community as applied above in Section 3.3.1.

Building on the initially identified contacts more contacts can be generated by snowballing. This will add to the diversity of participants and ensure that there is a wide welcome for all opinions and ideas.

4.2.3 Existing Conferences

As the wind energy community are in diverse locations with busy schedules, a practical way to arrange a face-to-face meeting or workshop is to use existing meetings and conferences. This would facilitate wider participation from those who work in the industry without the burden of adding another separate meeting to their already busy schedules. It is a normal practice to do this and it may even be possible to add the X-ROTOR meeting to an existing conference's publicity. This would be ideal in that it would encourage more participation.

4.3 Engagement methods

The engagement methods for the wind energy community are the same as for the principal host community except that the use of an existing event is perhaps the only practical way to find an opportunity for a meeting of the wind energy community.

4.3.1 Questionnaires

Online questionnaires are an excellent means to assess the interests and opinions of the wind energy community and to encourage interest in a face-to-face meeting. Such a questionnaire could take the form of an ASD, see below in Section 4.3.3.

4.3.2 Workshops

After having introduced the members of the community online, the way is clear for a face-to-face workshop which can take place in years 2 and 3 of the project. From the wind community's point of view this would be an opportunity to network and meet each other as well, as a means to investigate a potential new technology. In any case, it and would give the community a chance to benefit from each other's insights and experience.

4.3.3 ASD - Delphi Study

As discussed above in Section 3.5.3 an ASD based on the modified Delphi Study method of Revez *et al.* (2020) can be used either online or in person. It is quite likely that the participants will be familiar with a Delphi study and would welcome the chance to learn from other industry experts using it.

4.3.4 Feedback

In the same way as the Host Communities, it is good practice and respectful (not to mention RRI) to give back information to the participants regarding the X-ROTOR decisions made which used the community's input.

5 Conclusions

The aim of this deliverable was to describe the methods to identify and convene the two stakeholder groups, namely the host communities and the wider energy community. These groups will provide insights into the acceptability of the X-ROTOR concept, and to contribute to understanding the market requirements which X-ROTOR may fulfil as well as maximizing the environmental benefits of X-ROTOR.

The aim has been achieved by describing the selection methods used the host communities and the wider wind energy community. In particular, the following have been suggested as feasible ways forward. Firstly, select one principal host community which will be visited as part of the research project in years 2 and 3. This will be situated on the Scottish coast where the population may be expected to have a good knowledge of wind energy. Secondly, there will be four satellite host communities selected from at least two other European countries so that a wider range of opinions, concerns and practices may inform the research output. These satellite communities may be contacted online. The wider wind energy community will be initially recruited online followed by physical and online meetings coinciding with suitable conferences to facilitate attendance. Thirdly a combination of methods will be used to engage with the communities including an Asynchronous Structured Dialogue based on an adapted Delphi study as used by Revez *et al.* (2020). Finally, the aim of the engagement is to encourage as many diverse voices as possible to be heard, with an emphasis on the inclusion of people who are often underrepresented in society.

The descriptions here of the methods to identify and convene the communities will be a guide for the research and will be open to the suggestions and insights of the communities who take part. This is an essential part of participative action research.

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